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Research Article

Comparative Analysis of Reinforcement &Prestressed Concrete Beams

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Abstract

In this paper analyzed the RCC &PSC beams against the different loading conditions. We studied the analysis of prestressed concrete beams more effective as compared to reinforcement concrete beams in flexure. In this paper may introduced the simply supporeted beams under different loading conditions like point load & analyzed done by the stadd pro. Staad.pro is a general purpose structural analysis and design program with applications primarily in the building industry - commercial buildings, bridges and highway structures, industrial structures, chemical plant structures, dams, retaining walls, turbine foundations, culverts and other embedded structures, etc. There is a very good understand all aspect of prestressed concrete beam better than as compared to reinforced concrete beam in flexural against the different loading condition done by this paper.

Keywords: *RCC beams & PSC beams, Flexure, Loading Conditions etc.*

Introduction

Concrete is strong in compression, but weak in tension: its tensile strength varies from 8 to 14 percent of its compressive strength. Due to such a low tensile capacity, flexural cracks develop at early stages of loading. In order to reduce or prevent such cracks from developing, a concentric or eccentric force is imposed in the longitudinal direction of the structural element. This force prevents the cracks from developing by eliminating or con-siderably reducing the tensile stresses at the critical mid span and support sections at ser-vice load, thereby raising the bending, shear, and torsional capacities of the sections. The sections are then able to behave elastically, and almost the full capacity of the concrete in compression can be efficiently utilized across the entire depth of the concrete sections when all loads act on the structure.

Difference B/W R.C.C & P.S.C

R.C.C

1. Basic components are concrete & mild steel
2. Only the portion which lies above N.A. is considered to be useful in resisting external forces.
3. Use of high tensile steel as reinforcement result in wide cracks in tensile zone of concrete
4. It has weak crack resistance which causes corrosion of both reinforcement and concrete
5. Not economical for long span
6. Less stiffer
7. Wt. of structure is not reduced
8. Quantity of steel required is more
9. Steel have yield limit 200-300 N/mm2
10. M-20 (Minimum grade)

P.S.C.

1. Basic components are high strength steel & high strength concrete
2. Due to prestressing in concrete whole concrete can participate in resisting external forces
3. Use of high tensile steel cases no cracks at working loads
4. It has high crack resisting which prevents rusting of reinforcement & deterioration
5. More economical
6. More stiffer than R.C.C.
7. Reduce Wt. of structure neutralizing dead loads
8. Steel required is 1/3rd that for R.C.C.
9. As high as 2100 N/mm2
10. M-40 Pre tensioning, M-30 Post tensioning

Scope

The purpose of research is to suggest the analysis of prestressed concrete beams as compared to reinforcement concrete beams in flexure.

The aim of this research is to compare the economics, durability and structural analysis of the reinforced concrete and prestressed concrete beams. There is a very good research all aspect of prestressed

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concrete beam as compared to reinforced concrete beam in flexural. Aim of this research check the prestressed concrete beam & reinforced concrete under flexure conditions.& used different types of building construction like frame structures, railway sleepers, electric poles, bridges, gravity dams.

Literature Review

Comparative study of flexural behaviour of R.C.C. beam and prestressed concrete beam (M K Maroliya.Nov-Dec 2012)

The aim of this paper concludes that, the tow tensile strength of concrete is overcome either by reinforcing it or by prestressing. Both these methods have certain advantages and disadvantages, and one must be very careful with choosing one these two by taking into consideration the structural requirements and economics of the given problem. The common construction material for residential and commercial buildings and other allied structures is still reinforced concrete, though the prestressed concrete is better in structural behaviour, durability and economy. The aim of present work is to compare the economics and structural behaviour of the reinforced concrete and prestressed concrete beams and finding out the suitability of each. Results show that overall flexural behaviour of prestressed concrete beam is very good in all aspect compared to reinforced concrete beam

Economics of Continuous R.C.C. Beams Vis-à-vis Continuous Pre-stressed Concrete Beams(A.R.Mundhada, Mohammad Shahezad July-2012)

This paper presents the economics of continuous R.C.C. beams vis-à-vis continuous pre-stressed concrete beams. This work includes the design and estimates of continuous R.C.C. beams and continuous pre-stressed concrete beams of vari jet age, we have a host of construction techniques at our disposal. Steel structures, R.C.C. Structures, Core and hull type of structure (combination of steel & R.C.C. construction), Ferro-cement and prestressed concrete are some examples. At times this choice available leads to confusion. The best way is to select the type of construction, depending on the circumstances and type of structure. The aim of this paper is to design medium span continuous R.C.C. beams as well as continuous pre-stressed concrete variety and then compare the results. Programming in MS EXCEL is done to design the beams. The idea is to reach a definite conclusion regarding the superiority of the two techniques over one another. Results reveal that a continuous R.C.C. beam is cheaper than continuous pre-stressed concrete beam for smaller spans but vice versa is true for larger spans.

Flexural behavior of reinforced and prestressed concrete beams using FEA (Anthony J.Wolanski May 2004)

This thesis is a study of reinforced and prestressed concrete beams using finite element analysis to understand their load-deflection response. A reinforced concrete beam model is studied and compared to experimental data. The parameters for the reinforced concrete model were then used to model a prestressed concrete beam. Characteristic points on the load deformation response curve predicted using finite element analysis were compared to theoretical (hand-calculated) results. Conclusions were then made as to the accuracy of using finite element modeling for analysis of concrete. The results compared well to experimental and hand calculated.

Methodology

In this paper may introduced the simply supported beams under different loading conditions like point load & analyzed done by the stadd pro.we studied the prestressed concrete beams as compared to reinforcement concrete beams in flexure, & also check the structural behavior, durability.

Define the Material

- RCC Beam
  1. Young's modules = 210 kn per mm^2
  2. Poisson's ratio = 0.25
  3. Density of concrete = 25kn Per m^3

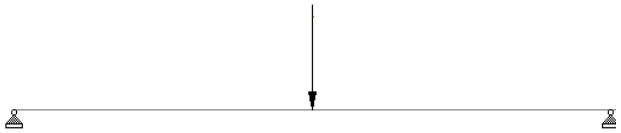
- Pre-stressed concrete beam

  1. Young's modules = 210 kn per mm^2
  2. Poisson's ratio = 0.25
  3. Density of concrete = 25kn Per m^3

Define the Load Cases

1. Point load case (W kn, Span's=L m)
2. Prestress force (W kn, Span's=L m, for PSC beams)

Point Load Case



- Beam Size: 200 mm X 400 mm
- Loading :Point load
- Span: Analysis of 3 m Span of simply supported beam(RCC &Prestressed concrete beams)
- Prestress force & eccentricity: 300 kn, ES=-100mm EM=-100mm EE=-100mm

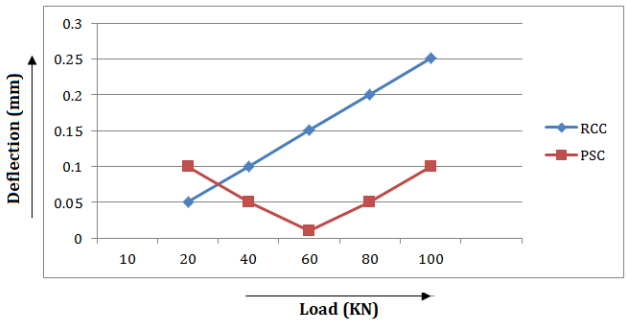
Note: All Data of RCC &Prestressed concrete beams like E,A,I, poison ratio, density of concrete are constant.

Loading condition

Loading Conditions	R.C.C.	P.S.C.
1	W=20KN , L=3M	W=20KN , L=3M
2	W=40KN , L=3M	W=40KN , L=3M
3	W=60KN , L=3M	W=60KN , L=3M
4	W=80KN , L=3M	W=80KN , L=3M
5	W=100KN , L=3M	W=100KN , L=3M

Results

For 3 M span (point load case)



Conclusions

The study of the flexural analysis of R.C.C. and prestressed concrete beams using different loading conditions. The following conclusions are summarized under cases given below:

For 3 m span simply supported beam

1) Max. displacement of PSC beam increased as compared to RCC beam against the loading conditions 1.
2) Max. displacement of PSC beam decreased as compared to RCC beam against the loading conditions 2.
3) Max. displacement of PSC beam decreased as compared to RCC beam against the loading conditions 3.
4) Max. displacement of PSC beam decreased as compared to RCC beam against the loading conditions 4.
5) Max. displacement of PSC beam decreased as compared to RCC beam against the loading conditions 5.

In this paper analyzed the RCC & PSC beams against the different loading conditions. We studied the analysis of prestressed concrete beams more effective as compared to reinforcement concrete beams in flexure using different loading conditions. The prestressed concrete is better in structural behavior, durability. The aim of this paper is to compare the structural analysis of the reinforced concrete and prestressed concrete beams using different loading conditions in flexure. Results show that overall flexural analysis of prestressed concrete beam is very good in all aspect compared to reinforced concrete beam.

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